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EXAMINER	
YEH, EUENG NAN	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/786,900	HUANG, WEI-FENG	
	Examiner	Art Unit	
	EUENG-NAN YEH	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-36 and 39-70* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-36 and 39-70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 13, 2008 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 4-17, 28-32, 36, 39-52, and 63-67 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Acharya (US 2002/0101524 A1, hereinafter referred to as Acharya002) and Yeo et al. (US 6,738,509 B2).

Regarding claims 1 and 36, Acharya002 discloses a color image processing system comprising:

act A: converting a single first image data from a first color space into a second image data that corresponds to a second color space (as depicted in figure 1A, image data converted from 8-bit Bayer color space to 24-bit RGB. Figure 1B depicted the conversion from 24-bit RGB space to 24-bit YCrCb. “Once each pixel of the image is at a full RGB color resolution (either through color interpolation or by virtue of having been captured at full color resolution), another process known as color space conversion may be performed. Depending on the rendering device or particular application for which the full color image is destined, the RGB "color space" (of an interpolated image, see FIG. 1(a)) may need to be converted …” in paragraph 10, line 1. The conversion equations from RGB color space to YCrCb color space are listed in paragraph 28);

the single first image data includes a first pixel and a second pixel, wherein the first pixel corresponds only to a first color component and the second pixel corresponds only to a second color component that is different from the first color component (as depicted in figure 1A for the 8-bit Bayer pattern “The Bayer pattern (see FIG. 1(a)), when three color planes are sub-sampled sampled, is characterized by including on a first row of an image, alternating pixels of Red and Green, and then on a next row alternating pixels of Blue and Green. Thus, the Bayer pattern for the first four rows of pixels (with each pixel typically an 8-bit value) is as follows (with the rows thereafter repeating the same pattern):

G R G R G R . . .

B G B G B G . . .

G R G R G R . . .

B G B G B G . . ..

As a result, each pixel location contains a value for a single color only" in paragraph 7, line 14).

Acharya002 discloses that color space can be converted to various desired color spaces. Acharya002 does not explicitly disclose image processing on the selected color space.

Yeo, in the same field of endeavor of color image processing ("compressing multi-spectral images in different spectral spaces and transforming images from one spectral space to another" at column 1, line 14), teaches image processing under various color spaces "a multi-spectral image is a collection of two or more monochrome images of the same scene. Multi-spectral images can be described in any one of a plurality of known spectral or color spaces. For example … RGB color spectral space … CIE (Commission Internationale de L'Eclairage) L*a*b*, CIE XYZ, CIE L*u*v*, CIE YUV, CMY … CMYK …YCbCr, YIQ, HIS, and HSV …" at column 1, line 20. As depicted in figures 2 and 3, numeral 105 is the codec processing in the second color space to form a processed image data (claim act B) and numeral 116 to convert the processed image data to the third color space in figure 2 (claim act C) or to the first color space in figure 3, numeral 304 (claim act C), or to color space 2 in figure 3, from numeral 102 to numeral 116 (claim act C), where the conversion method used, figure 4 or figure 5 of Yeo, is different from the method Acharya200 used for act A.

It would have been obvious at the time the invention was made to one of ordinary skill in the art would have been motivated to include the color image processing system Acharya002 made, with color space data processing as taught by Yeo, because there are practical applications for color space and data processing: “Most JPEG images are compressed in the YCbCr color space. For MPEG-1 this is the only allowed color space” at Yeo column 2, line 36, and “image editors or rendering devices such as printers do not use RGB color space in manipulating or rendering images …” in Acharya002 paragraph 10, line 8.

Regarding claims 4 and 39, the first color space is an RGB raw space (as depicted in Acharya002 figure 1A 8-bit Bayer pattern "In digital still and video cameras and certain other imaging devices, raw images are first represented as rectangular row and column of pixels with each pixel having the intensity value of a particular color only. In the case of RGB (Red, Green and Blue) sub-sampling imaging devices, images are obtained and stored in a particular pattern. FIG. 1(a) shows are such pattern ..." in Acharya002 paragraph 7, line 6).

Regarding claims 5 and 40, the second color space is a single color component color space (discussed in claims 1 and 36, the color space can be described in any one of a plurality of known color spaces. The second color space is a single color component color space).

Regarding claims 6-7, and 41-42, the second color space is a multiple color component color space (discussed in claims 1 and 36, the color space can be described in any one of a plurality of known color spaces. See also "… color space 2 may be YCbCr color space. Other color space combination are also possible …" at Yeo column 4, line 49).

Regarding claims 8-10 and 43-45, the third color space is a single color component color space (discussed in claims 1 and 36, the color space can be described in any one of a plurality of known color spaces. The third color space can be a single color component color space, a multiple color component color space, or RGB raw space, or YCbCr space).

Regarding claims 11 and 46, act A further comprises using one or more temporary buffers to store the second image data (as depicted in Acharya002 figure 6, numerals 711 and 734 for storages. See also "… a system unit having a central processing unit (CPU) and associated volatile and non-volatile memory, including all RAM …CD-ROM drive …" at Yeo column 10, line 42).

Regarding claims 12 and 47, act B further comprises using one or more temporary buffers to store the processed image data (discussed in claims 11 and 46).

Regarding claims 13 and 48, act B further comprises image data compression (as depicted in Yeo figure 9 for data compression process).

Regarding claims 14, 28, 49, and 63, act A further comprises performing a color interpolation for converting each pixel that is associated with the first image data from a single color component to multiple color component to form a corresponding interpolated pixel (as depicted in Acharya002 figure 1A from 8-bit Bayer pattern to 24-bit RGB. For the performance of color interpolation "…To interpolate the Green color component G'01, one method of color interpolation would average together adjacent Green color plane associated pixel values which are, for instance, G00, G11 and G02. Thus G'01 might be determined by computing (G00+G11 +G02)/3 …" in Acharya002 paragraph 27, line 15. This interpolation is the nearest neighbor interpolation (claims 28 and 63). More complete discussion can be found in paragraph 27).

Regarding claim 15 and 50, applying a conversion equation to each interpolated pixel, wherein the conversion equation is selected based on the second color space ("For instance, when converting from RGB color space to the YCrCb color space, a set of conversion equations are defined such that for a given pixel location (ij) each component Y, Cr and Cb is a linear combination of R, G and B components …" in Acharya002 paragraph 28, line 1. More complete discussion can be found in paragraph 28).

Regarding claims 16 and 51, act A further comprises applying a conversion equation to each pixel, wherein the conversion equation is selected based on the second color space (as depicted in Acharya002 figure 2, shows the steps of color space pixel by pixel conversion. Detail discussions about the conversion formula used can be found from paragraphs 27 to 29).

Regarding claims 17 and 52, color interpolation further comprises deriving missing color components for each pixel from the pixel's neighboring pixels, wherein the neighboring pixels contain the missing color components (as discussed in claims 14 and 49, G'01 = (G00+G11 +G02)/3 where G'01 is the missing color components, G00, G11, G02 are neighboring pixels of G'01. Reference Acharya002 figure 1A for details).

Regarding claims 29 and 64, act C further comprises re-mapping each pixel of the processed image data into the selected color space (as depicted in Acharya002 figure 1C, the 24-bit YCrCb data decimated to 12-bit YCrCb).

Regarding claims 30 and 65, act C further comprises applying a conversion equation to each pixel of the processed image data, wherein the conversion equation is selected based on a selected color space from the set of color spaces (as depicted in Yeo figure 4, numeral 402 or figure 5, numeral 502 shows the color space conversion equations).

Regarding claims 31 and 66, after applying the conversion equation, re-mapping each pixel of the processed image data into the selected color space (as discussed in claims 30 and 65 conversion equation applies to each pixel; claims 29 and 64 to re-map each pixel of the processed image data into the selected color space).

Regarding claims 32 and 67, re-mapping includes dropping undesired color components (as depicted in Acharya002 figure 1C and figure 4, the undesired color components of Cb and Cr are dropped so the file size can be reduced).

4. Claims 18-27, 33-35, 53-62, and 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Acharya002 and Yeo as applied to claims 1 and 36 discussed above, and further in view of Rashkovskiy et al. (U.S. 6,252,577 B1).

Regarding claims 18 and 53, the Acharya002 and Yeo combination discloses color space interpolation. The Acharya002 and Yeo combination does not explicitly disclose other possible color space interpolation acts and the filters.

Rashkovskiy, in the same field of endeavor of "digital image processing" at column 1, line 5, discloses the details of interpolation from a single color component to a multiple color component: "A method according to an embodiment of the invention operates to partially determine the scaled image, leaving missing components in the second and third sets of pixels. The partial determination may be done using linear mathematical operators that combine interpolation and low pass filtering and are applied to selected regions of the original image" in column 2, line 30. Furthermore, "the well

known Hamming filter works particularly well and is relatively simple to implement" at column 6, line 66. "each pixel in the original image is converted from having a single color component into one pixel having multiple color components … by interpolating the additional color components of a pixel based on the intensities and colors of its neighboring pixels …" at column 1, line 37. Thus, the interpolation is based on nearest neighbor interpolation. The said selected region of the original image is a 3X7 array with 21 Bayer pattern coefficients (at column 4). The interpolation "may take on a larger or smaller size. In addition, the array need not have an odd number of coefficients on each side" at column 5, line 1. Equation (1) (at column 5) is the interpolation formula used where cg(i,j) is the weighting coefficient. For a 1X3 region, the missing color component G(2) can be derived from the pixel's closest previous G(1) and next pixel G(3) in a horizontal direction (act P for claims 18 and 53). G(2) can be the averaged output if the weighting factor cg is 0.5. Otherwise, G(2) is the weighted output.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to implement the color space transformation methodology of the Acharya002 and Yeo combination, with more single/multiple color interpolation options as taught by Rashkovskiy, in order not only to explicitly describe the steps of color interpolation processing for "efficiently downscaling images and for transferring images" at Rashkovskiy column 1, line 6, but also to avoid "any aliasing effects" at Rashkovskiy column 7, line 31.

Regarding claims 19-20 and 54-55 (discussed in claims 18 and 53, for the averaged output and the weighted output).

Regarding claims 21-22 and 56-57, act S further comprises averaging pixels corresponding to each missing color component from the previous line of pixels (With proper selection of the size of target area, Rashkovskiy Equation-1, at column 5, and 2, Equation-2, at column 6, can be used to derive averaged or weighted pixel values corresponding to each missing color component from the previous line of pixels).

Regarding claims 23 and 58, the fixed number is based on missing color components from previous frames ("… missing components, however, may now be readily computed using conventional interpolation techniques as will be apparent to those of ordinary skill in the art …" at Rashkovskiy column 4, line 1. Thus, the fixed number is based on missing color components from previous frames is one acceptable alternative method).

Regarding claims 24 and 59, low-pass filters used ("next step is to determine the filtering that will be applied to the selected region to generate the G component of the target pixel in the scaled image … Equation-3 …" at Rashkovskiy column 6, line 13. "Any one of a number of different filters can be used for h(j), but the well known Hamming filter works particularly well …" at Rashkovskiy column 6, line 64. Where

Hamming filter is a low pass filter and variable G'(j) in equation-3 is the value after interpolation).

Regarding claims 25-27 and 60-62, using filters before, after, before and after performing the color interpolation (as discussed in claims 24 and 59, performing filter after interpolation. However, Equations-4 and 5 of Rashkovskiy at column 6, perform the filter before interpolation for G(i) is the value before interpolation. Without departing from the essence of Rashkovskiy's methodologies, filters can be applied before and after performing the color interpolation).

Regarding claims 33-35 and 68-70, using filters before, after, before and after dropping undesired color components (discussed in claims 25-27 and 60-62 this filter can be applied before, after, and before and after color interpolation. Without departing from the scope and spirit of Rashkovskiy's methodologies, this filter can also be applied before, after, and before and after dropping undesired color components).

Response to Arguments

5. *Summary of Applicant's Remarks*:

"Thus, independent claim 1 includes converting a single first image data that includes a first pixel corresponding only to a first color component and a second pixel corresponding only to a second color component that is different from the first color

component. Applicant respectfully submits that Yeo fails to disclose this expressly" at response page 22, line 1.

"Thus, amended claim 36 includes converting the processed image data to a third image data of the second color space, but using a conversion method that is different than the conversion method that is used in the initial conversion of the first image data. Applicants respectfully submit that Yeo fails to disclose at least this expressly recited element" at response page 23, line 11.

Examiner's Response:

Applicant's argument is moot in view of the new grounds of rejection advanced herein above. Specifically, the combination of Acharya (US 2002/0101524 A1, hereinafter referred to as Acharya002) and Yeo et al. (US 6,738,509 B2) reference now teaches the claimed Bayer color space. Refer to the rejections above.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eueng-nan Yeh whose telephone number is 571-270-1586. The examiner can normally be reached on Monday-Friday 8AM-4:30PM EDT.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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